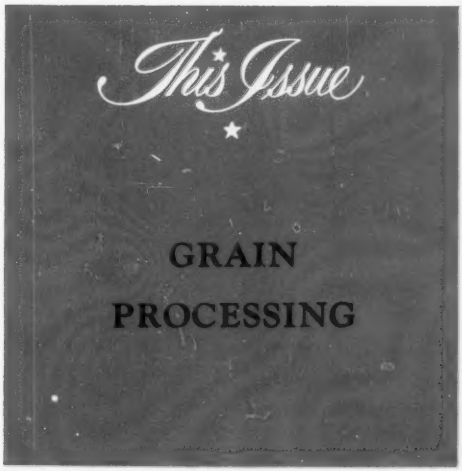
*Volume 46* AUGUST, 1960 *Number 8*

# Lubrication

## A Technical Publication Devoted to the Selection and Use of Lubricants

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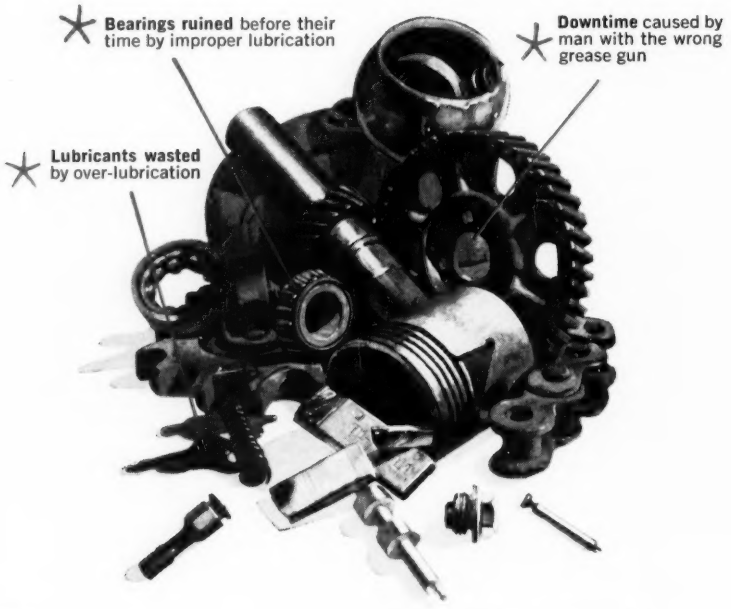


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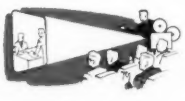

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# LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

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# GRAIN PROCESSING

GRAIN processing is today one of the larger food manufacturing businesses. This article will be concerned with the lubrication of the machinery associated with the many phases of this broad industry. To begin, the grain must be unloaded from the ship, railroad car or truck as received and then transported by conveyors to the grain elevators for temporary storage until processing. Figures 1 and 2 illustrate two different types of box car unloaders, while Figure 3 shows the common belt-type conveyor.

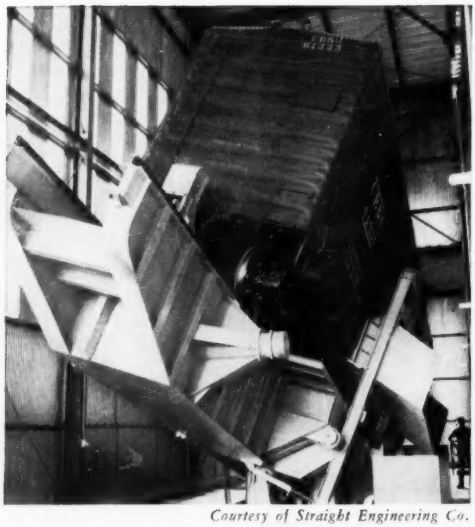
Grain is withdrawn from the elevators as required and conveyed through such processes as flour milling, feed milling, blending, malting, and cake and cereal making to name a few. While types of equipment depend of course upon the desired nature of the final products and the particular plant, some of the more common pieces are separators, mills or grinders, purifiers, screens or bolters, mixers, blendors, and pelleters with their connecting conveying systems. Figure 4 presents a schematic material flow diagram for a mill producing both flour and animal feed.

After the grain has been processed into a finished product it must then be packaged, consequently package making, filling and sealing machinery is included in this discussion. As will be seen, packaging machinery is normally large and complicated and must rely a great deal on proper lubrication and maintenance.

The overall operation of grain processing involves moving large quantities of material under a wide variety of ambient conditions, ranging from extreme winter cold at the unloading and elevating locations to very warm temperatures and high humidity during summer within the mills themselves. In addition to the large temperature variation that is encountered, some of the machinery involved in these operations is required only periodically while other pieces of machinery operate virtually continuously. Another characteristic of the grain processing business is the extremely "dusty" atmosphere which is generated by the product itself and in which the various pieces of machinery must usually operate. These varied operating conditions have not hitherto encouraged simple maintenance and lubrication practices, yet all of the equipment involved must be lubricated properly to operate satisfactorily. Good lubricants and lubrication practices save money by reducing power consumption, cutting downtime, increasing equipment life and reducing maintenance costs.

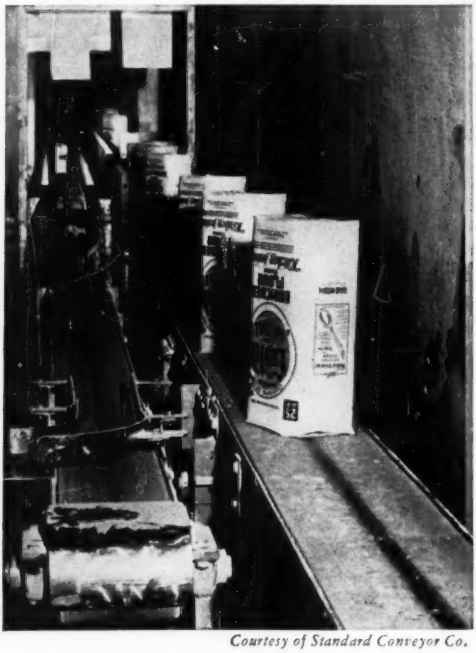
A large portion of the mechanical equipment involved in the grain processing industry today is over ten years old, but much of it is being replaced or modernized to make it more automatic and to increase production. New plants are designed in such a way that the flow processes are almost continuous, thereby approaching complete automation.

One of the most important steps in equipment modernization has been the change from the sleeve or plain type bearing to the modern ball or roller anti-friction type in such grain handling equipment as large ship unloaders, hydraulic railroad



*Courtesy of Straight Engineering Co.*

**Figure 1 — An hydraulically-powered railroad boxcar unloader which pours the grain out an open side door by side-tilting the car 18° then end-tilting it 37° in each direction until emptied.**

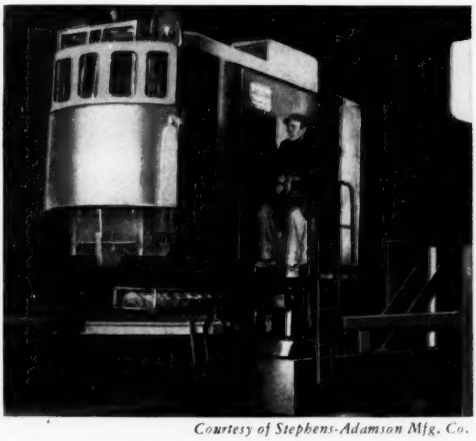


*Courtesy of Standard Conveyor Co.*

**Figure 3 — Two belt type conveyors transporting 25 pound paper bags of flour.**

car unloaders and bucket elevator lifts. Anti-friction bearings permit grease lubrication which enables machines to operate better for longer periods between relubrication and overhaul. Grease-lubricated anti-friction bearings mounted in sealed housings also show less effect from the temperature changes, and dust conditions which are ever present with grain handling machinery.

Along with the modernization of the grain handling equipment has come the development of new equipment and new techniques which are useful in the reduction of grain spoilage while in storage. These new techniques permit air to be circulated through the grain in the elevators to control moisture and grain temperature, thus reducing damage caused by insects, mold, and freezing.



*Courtesy of Stephens-Adamson Mfg. Co.*

**Figure 2 — An hydraulically activated boxcar unloader which operates through the side door of a car.**

## CONVEYING EQUIPMENT

Conveying equipment used to handle grain and grain products is vital to the modern mill, but is essentially similar to that used in other industries. Screw type and belt type conveyors are used extensively, however the older bucket type conveyor is being restricted to handling whole grain and large-grained mill products. For transporting the finer materials like flour, bucket conveyors are being replaced with the new pneumatic systems in which the product is "fluidized" in air and pushed or sucked from machine to machine through large aluminum or stainless steel tubes as shown in Figures 5 and 6. In addition to transporting flour very efficiently and reducing extraneous dust, the propelling air in a pneumatic system also helps to separate the fine from the coarse flour and assists in controlling its humidity, thereby facilitating subsequent grinding and screening. The air pumps or exhausters, which are the vital parts of a pneumatic conveying system, require a premium-quality turbine-type oxidation-inhibited oil to perform at their best.

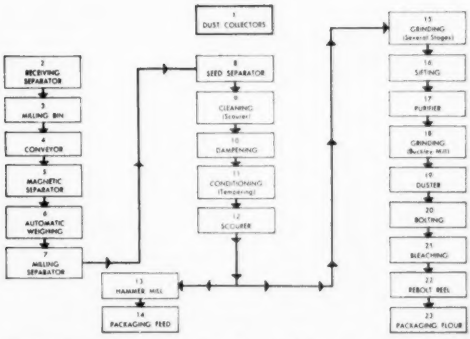
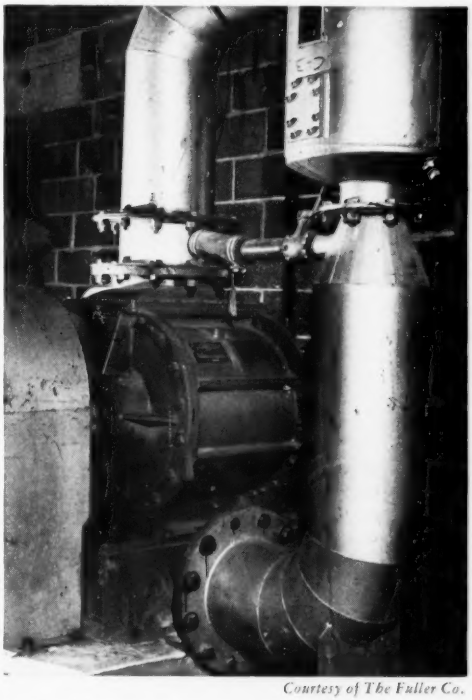



**Figure 4 — Flow diagram for a typical flour and animal feed mill.**

The latest screw and belt type conveyors use anti-friction bearings which are grease lubricated. The screw conveyor, a rolled steel spiral motor-driven through a gear box, is commonly used for the horizontal movement of product through a trough-like housing which may be open or covered. One short conveyor of this general type may be seen in Figure 2 and some very long ones appear at the top of Figure 12. Very long screw conveyor installations require intermediate support bearings which must be of the sealed type to prevent lubricant contamination from the product being conveyed. To protect them, the end or main screw support bearings are set outside and away from the ends of the conveyor housing. In the past, impregnated wood-block "bearings" were used as intermediate supports in many screw conveyors and these bearings were not sealed or protected in any fashion from the product being conveyed. Once these old-fashioned block bearings were installed, they were never relubricated but merely replaced when worn out with attendant considerable downtime for the whole mill. Anti-friction type support bearings not only greatly reduce power requirements, but permit periodic relubrication and thus a much longer service life than the old type block bearings.

The use of anti-friction bearings on belt conveyors has similarly provided much greater reliability and reduced power requirements, especially in very long systems.

Modernization of many mills has included elimination of the old power shaft, ceiling line shafting and belt drive systems. Such items as conveyors

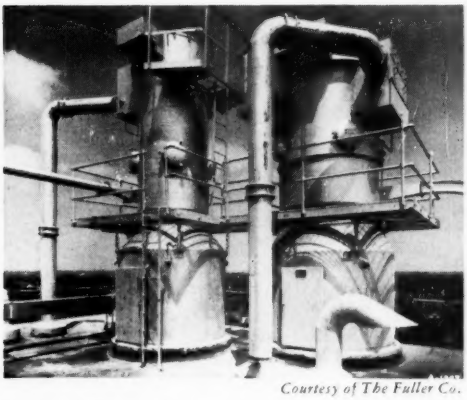


*Courtesy of The Fuller Co.*

**Figure 5 — Positive displacement exhauster used to power an Airveyor (air conveyor) system.**

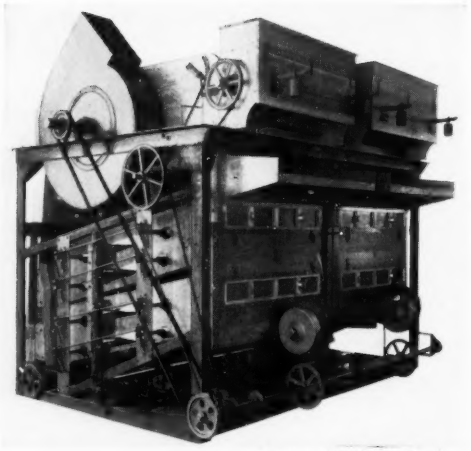
are now being driven by their own electric motors through gear boxes or speed reducers. These modern power transmission units are built with oil-tight and dust-tight cases thus permitting the gears to be lubricated without contamination. A premium quality rust and oxidation inhibited turbine oil with a viscosity of about 300 SUS @ 100°F is usually recommended to keep power losses and gear wear to a minimum.

Where gears operate in the open or in housings that are not oil- or dust-tight, relubrication is necessary at shorter intervals to remove the contaminated lubricant. The lubricant must of necessity be of a type that will not allow the oil and dust mixture to build up on the gear teeth to cause excessive



*Courtesy of The Fuller Co.*

**Figure 6 — Separators of Airveyor system installed on top of a feed elevator.**



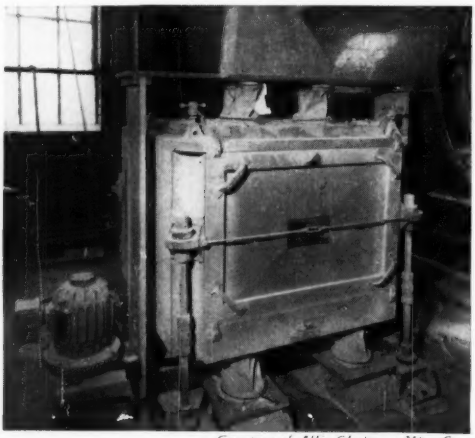
*Courtesy of S. Howes Co., Inc.*

**Figure 7 — An Eureka double twin-shoe super cleaner used to clean grain before milling.**

bearing pressures and wear.

Electric motors, the muscles of present-day unitized equipment, are principal users of grease-lubricated anti-friction bearings and are frequently of the wholly-inclosed type shown in Figure 9. These modern heavy duty motors give long periods of uninterrupted service when lubricated with a premium quality ball and roller bearing grease of NLGI Grade 2.

Exposed driving chains are frequently employed to transmit power such as between a gear reducer and a conveyor shaft. These chains should be lubricated either by periodically brushing lubricant uniformly over their surfaces or by removing and immersing the entire chain in lubricant. In an extremely dusty atmosphere frequent cleaning and relubrication is desirable.

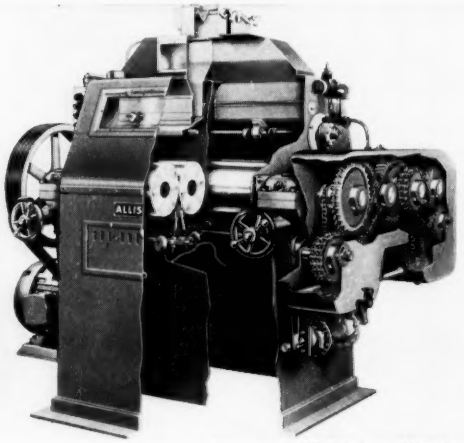


*Courtesy of Allis-Chalmers Mfg. Co.*

**Figure 9 — Gyratory sifter used to separate four sizes of relatively coarse middlings prior to further milling.**

## FLOUR MILLING

Flour milling is a very important part of the grain processing industry and requires a large quantity of highly specialized mechanical equipment. As indicated in Figure 4, flour milling or the reduction of coarse whole grain into ultra fine flour, is accomplished in many stages, frequently repetitive with intervening separations or screenings. Before whole grain is even permitted to enter the milling process, however, it must be cleaned thoroughly in machines like that illustrated in Figure 7. The actual milling is accomplished by subjecting the grain, and middlings (coarse flour) to repeated passes between the precisely machined rolls of a modern mill like that illustrated in Figure 8 which is equipped with its individual drive motor. The care exercised in enclosing the drive chains and gearing, and the provision of oil-mist and dip-chain lubrication systems are particularly noteworthy. Each pass through such a mill is usually followed by separation or screening. Machines like that shown in Figure 9 might be used for relatively small volume separation while batteries of free-swinging sifters are more common in high production. A modern maintenance and lubrication program is obviously essential for mill equipment which may be required to operate 24 hours a day, five to six days a week to meet consumer demand.

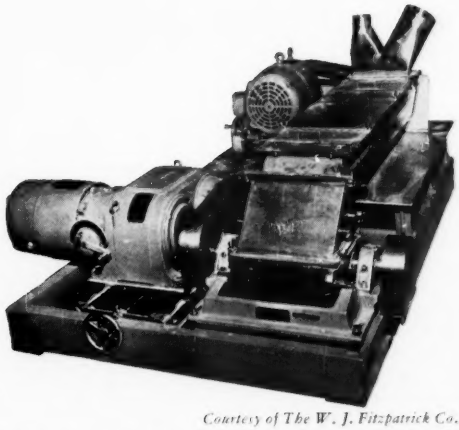



*Courtesy of Allis-Chalmers Mfg. Co.*

**Figure 8 — Sectional view of Air-Set double roller mill. Note air-set diaphragms at lower right and the extensive provisions to enclose and lubricate drive gears and chains.**

## CAKE MIXES

The manufacture of preformulated cake mixes from flour and many other ingredients has grown



*Courtesy of The W. J. Fitzpatrick Co.*

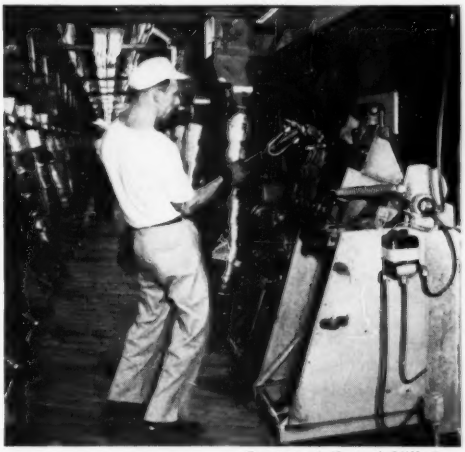
**Figure 10 — A Malaxating machine or continuous blender-mixer for pie crust, cake mix and cereal slurries. Note separate motors for twin mixer feed screws and variable speed comminutor drive in foreground.**

to be a large part of the grain processing industry in recent years. The major processing equipment used is a blendor-mixer like that shown in Figure 10. Because of its modern design, such equipment is relatively easy to operate and maintain at maximum efficiency.

## CEREALS

Cereal manufacturing is a most important and growing segment of the food and grain industry. Many of today's cereals are manufactured by secret or patented processes which require special machinery frequently constructed by the cereal manufacturer himself. Should any special lubrication difficulties be encountered in such machinery which cannot be satisfied with regularly-recommended lubricants or maintenance, the services of a trained lubrication engineer should be solicited.

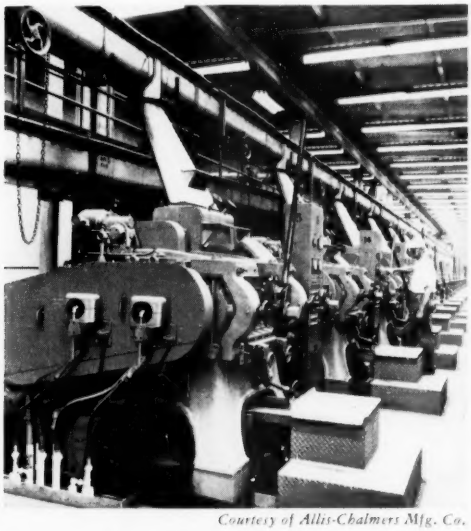
Some of the special cereal machines take blend constituents from several conveyors, proportion and blend them in special continuous hot mixers and then form distinctive shapes by passing through a uniquely designed pelleting mill. The resultant pellets may then be expanded while being "shot from a gun" like those shown in Figure 11 or rolled into some sort of a flake by means of equipment like that illustrated in Figure 12. A "gun" consists of a high pressure tube sealed at one end and loaded and closed at the other end. The raw cereal pellets are heated in the gun until the internal pressure rises to a predetermined level, when the cover is suddenly released and the high pressure air, steam and cereal explode or expand out of the gun with considerable force.



*Courtesy of General Mills Inc.*

**Figure 11 — A battery of "guns" used to puff Cheerios. The gun in the right foreground has been charged with cereal pellets and is being closed preparatory to heating and "firing" downward into a collecting cage.**

Some cereals are additionally coated with a sugar solution. Before packaging, most cereals are passed through an oven to crisp them.

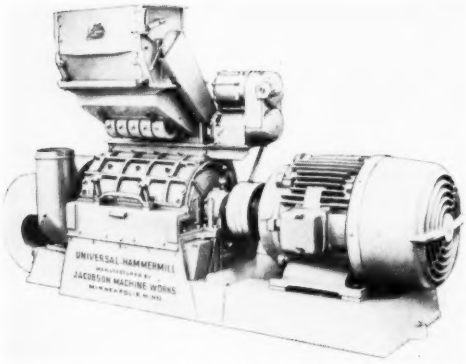


*Courtesy of Allis-Chalmers Mfg. Co.*

**Figure 12 — A battery of fifteen modern flaking mills with 28 inch length rolls used to flatten cereal pellets into flakes. Note long screw-type input conveyors, oil-tight inclosure and central lubrication system for roll drives, and excellent housekeeping.**

## ANIMAL FEEDS

Feed mills normally do not require as wide a variety of equipment as flour mills since the component materials need not be ground as finely. A



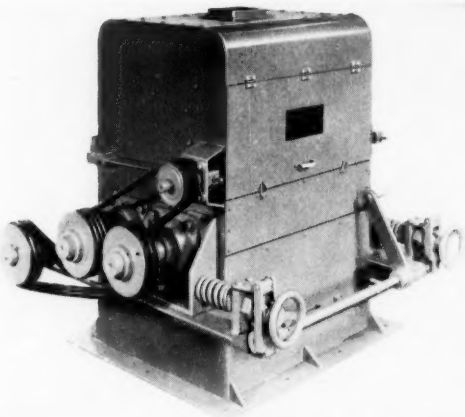

*Courtesy of Jacobson Machine Works Inc.*

**Figure 13 — A one hundred horsepower hammermill with adapter, magnet, variable speed feeder and rotary air syphon separator used in reducing whole grain to feed.**

hammer mill like that shown in Figure 13 is usually used to reduce whole grain to the proper size for mixing. In such equipment, hard-faced, throw-type hammers revolving at high speed within a chamber crush the grain by impact. Screens at the bottom of this chamber control the size to which the grain is reduced. Grain may also be broken in an oat crimper like that shown in Figure 14. Continuous-type mixing machines as illustrated in Figure 15 are used to blend the several liquid and solid feed ingredients before the mix is pelleted and packaged. A pelleter, illustrated in Figure 16, forces the feed mix through holes in a revolving die and cuts off the extruded material into pellets of a predetermined size. Feeds are pelleted to reduce their volume and facilitate handling.

## MALT

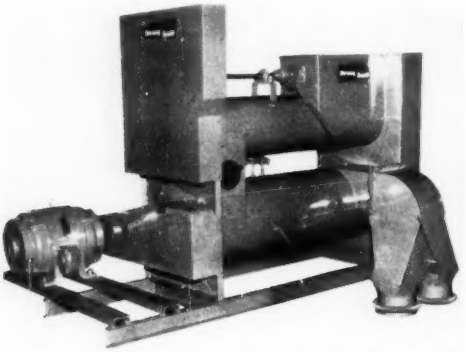
Malt, a specially processed form of barley, rye,



*Courtesy of S. Howes Co., Inc.*

**Figure 14 — A Eureka oat crimper and corn cracker used in preparing animal feeds.**

wheat and other grains is used widely in the food, beverage and pharmaceutical industries. It is produced either by batch processing, or in huge semi-continuous equipment (like that shown in Figure 17) by soaking the grain in water, germinating (sprouting) the grain kernels under controlled temperature and very high humidity, and then at the proper time kilning (heating and drying) the germinated grain to prevent further growth. The malting process takes approximately ten days and subjects the equipment to such a wide variety of temperature and humidity conditions that special attention to lubrication is frequently required.

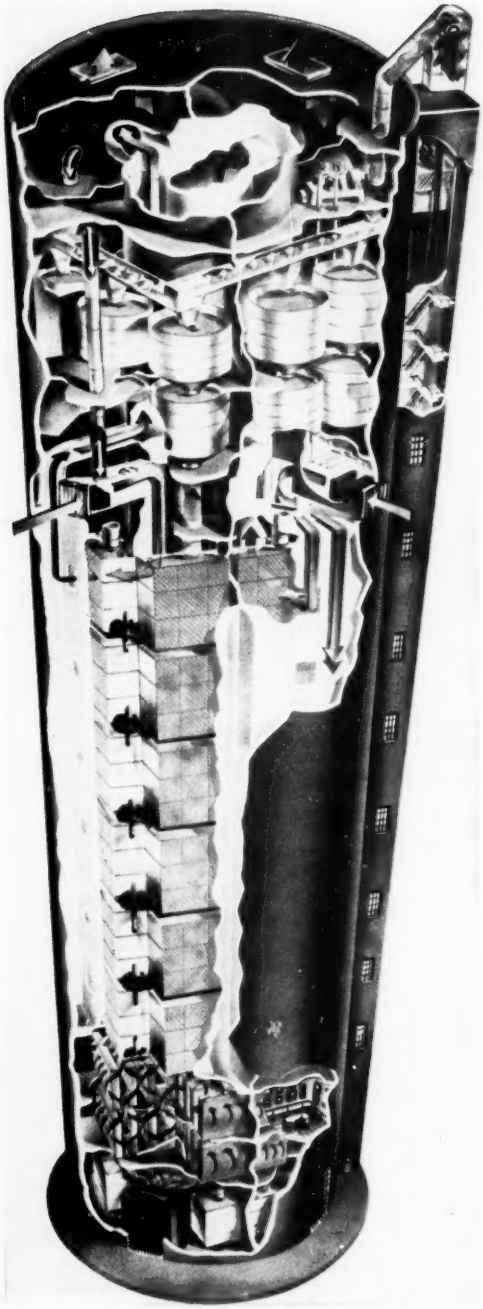


*Courtesy of Strong Scott Mfg. Co.*

**Figure 15 — A Mix-All high speed continuous blender used in blending molasses, animal fats, fish solubles, etc. into animal feeds.**

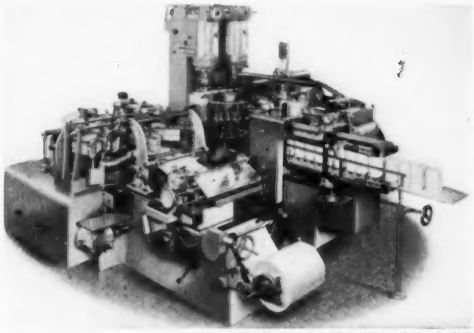
*Courtesy of Sprout, Waldron & Co., Inc.*

**Figure 16 — Sectionalized view of pelleting machine with a capacity of more than ten tons of pellets per hour. Note feed screw at upper right and provision for injecting liquids or steam before mixing and pelleting.**



*Courtesy of George J. Meyer Malt & Grain Corp.*

**Figure 17—A Frauenheim continuous automatic gravity malter.**



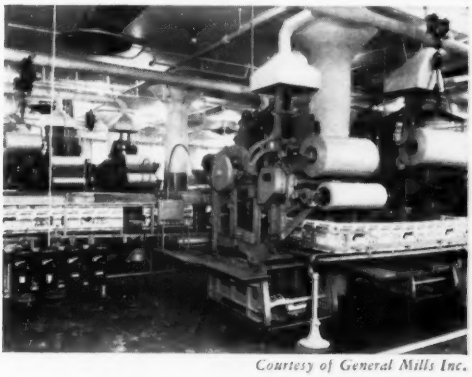
*Courtesy of F. R. Hesser Maschinenfabrik AG*

**Figure 18 — A Hesser automatic packaging machine which makes bags from roll paper, fills and seals them at a rate of about 50 five pound bags per minute.**

## PACKAGING

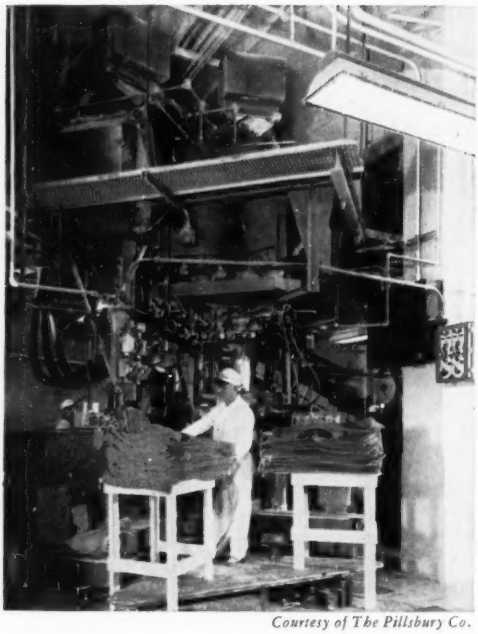
A modern integrated packaging machine such as illustrated in Figure 18 starts with a roll of pre-printed paper, cuts it accurately into individual sheets, folds each sheet into a bag, fills the bag, weighs it, inserts a coupon and then seals it. Such a machine packages flour in either two or five pound sizes at the rate of approximately 50 packages per minute. A very complex machine such as this may be hand lubricated at approximately 500 lubrication points.

Other packaging systems for boxing cereals or cake mixes may consist of several separate machines for making the outer boxes, folding the paper liner, and placing it in the box, filling the box with product, and sealing both the liner and box. Figure 19 illustrates two such machines engaged in packaging a well-known breakfast cereal. Semi-automatic baggers like that shown in Figure 20 are frequently used to fill, weigh and sew 50 and 100 pound bags. Larger or "bulk" quantities of product



*Courtesy of General Mills Inc.*

**Figure 19 — Automatic packaging machines making and inserting wax paper liners in cereal boxes.**



*Courtesy of The Pillsbury Co.*

**Figure 20 — Semi automatic machine for filling 50 or 100 pound cloth or paper bags.**

are not usually packaged but are weighed into and shipped in truck bodies or railroad cars that are specially built for this purpose. As can be seen, the manufacture and filling of small consumer packages requires much expensive and complicated equipment which must be lubricated regularly in order to maintain peak efficiency.

## SIMPLIFIED LUBRICATION PLAN

Increased production and decreased costs are being obtained in modern grain processing plants by modernizing, integrating and automating equipment. As a consequence the many steps in converting rough grain to finished saleable product are now accomplished so smoothly and rapidly that material literally flows through a mill. The sole drawback to such an efficient arrangement is that the failure of a single part among the thousands in the many machines may be quite enough to stop all of them: profits immediately cease and the resultant "downtime" is not only ruinous to the tightly coordinated production schedule, but overhead charges on such a large capital investment will accumulate at a frightening rate.

To be profitable the mill must be kept running: the surest guarantee of success is correct lubrication which requires six "rights" — the right *type* and right *quality* of lubricant in the right *condition* and the right *amount* at the right *place* and the right *time*. Every one of the few dollars invested in correct lubrication will provide the cheapest possible protection against expensive corrosion, wear and failure. The price of good lubrication is infinitesimal when compared to the costs it prevents. Attempts to "save money" by slighting any of the six lubrication "rights" can be expensive indeed.

### Right Type, Right Quality

Much confusion, uncertainty of lubrication and unnecessary expense has resulted from the too common fault of stocking and trying to use a greater variety of lubricants than is actually required by the machines. The inside rear cover of this issue presents a simplified lubrication plan requiring only three lubricant types of adequate quality which gives very substantial monetary and other savings wherever it is adapted to a specific mill by a trained lubrication engineer. The basic principle of the plan is that a lubricant of the right type and right quality can do many jobs well, whereas the opposite is never true. The versatility alone of a high quality lubricant more than compensates for its small additional cost.

### Right Condition

The best of lubricants and their subsequent ability to lubricate are too often destroyed through improper storage and handling, a subject which is thoroughly discussed in a previous issue[1] of this publication. Through its reduction of lubricant types and confusion, the simplified lubrication plan greatly assists in the maintenance of right condition.

### Right Amount, Right Place, Right Time

The best of lubricants in the best of condition are still ineffective unless sure provision is made to apply them in the right amount at the right place and the right time. Equipment manufacturers are well aware of these three final vital steps in the lubrication process and are increasingly building specialized and often automatic lubrication systems into their equipment which are designed to accomplish these steps with minimum human effort and the attendant possibility of human error. Hand oiling, for example, of the more complex machines has largely given way to the centralized system, while previously open mechanisms are now housed wherever practicable to permit grease, circulating oil or oil bath lubrication.

## SUMMARY

Leaders in the grain processing industry are achieving increased production and lower costs by modernizing or replacing older machines, by integrating and often automating them, and by installing a simplified lubrication plan.

[1]Magazine Lubrication, Sept. 1955, "Handling of Lubricants."



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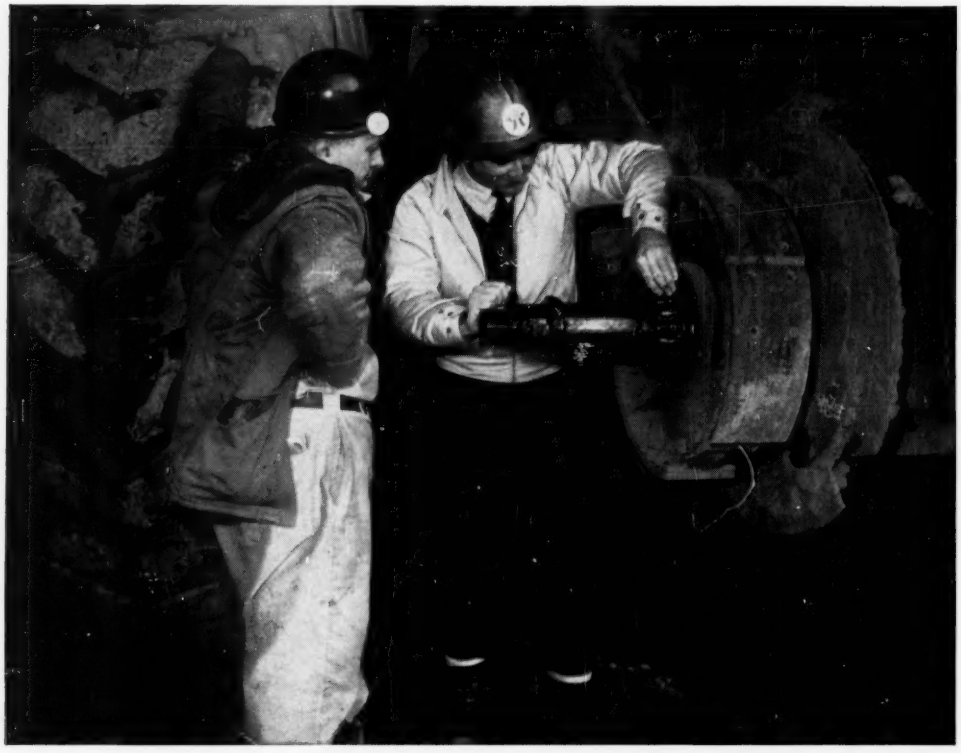
# TEXACO

## SIMPLIFIED LUBRICATION PLAN
FOR
## GRAIN HANDLING MACHINERY

Adaptable to conveyors, elevators, car unloaders, blowers, ovens, dryers, cutters, separators, sifters, purifiers, mills, rollers, mixers, packagers, and baggers

| Mechanism | Texaco Lubricant |
|---|---|
| Air compressors, reciprocating | Regal Oil C R&O |
| Air line lubricators, oil cups | Regal Oil C R&O |
| Ball and roller bearings, oil lubricated, normal temperatures | Regal Oil C R&O |
| Electric motors, oil lubricated | Regal Oil C R&O |
| Hydraulic and centralized oil lubrication systems | Regal Oil C R&O |
| Enclosed spur and helical gearing, normal temperatures | Regal Oil C R&O |
| Enclosed roller and silent chains | Regal Oil C R&O |
| Plain bearings: mist, bath or circulating oil systems | Regal Oil C R&O |
| Vacuum pumps, exhausters | Regal Oil C R&O |
| Air compressors, rotary | Regal Oil F R&O |
| Ball and roller bearings, oil lubricated, elevated temperatures | Regal Oil F R&O |
| Enclosed spur and helical gearing, elevated temperatures | Regal Oil F R&O |
| Screw feeds | Regal Oil F R&O |
| Plain bearings: elevated temperatures | Regal Oil K R&O |
| Exposed cams, slides, slide rods; oil lubricated | Regal Oil K R&O |
| Exposed roller and silent chains | Regal Oil K R&O |
| Exposed spur and helical gearing; all worm types | Regal Oil K R&O |
| Ball and roller bearings, grease lubricated | Multifak 2 |
| Electric motors; grease lubricated | Multifak 2 |
| Exposed cams, slides, slide rods; grease lubricated | Multifak 2 |
| Plain bearings: grease lubricated | Multifak 2 |
| Shaft couplings, gear type | Marfak Heavy Duty 2 |



# 2nd Reason Texaco is 1st at Niagara Power

Four of the six major construction contracts on the Niagara Power Project are lubricated and serviced by Texaco.

Niagara is the western world's greatest power project. Contractors are moving 39,000,000 cubic yards of rock and overburden. They are constructing a 60,000 acre-foot reservoir. They are building a great power station that will start producing power in February, 1961. The $720,000,000 cost is privately financed.

The selection of Texaco by a majority is significant. The Niagara contractors must keep equipment working, and they must have the finest lubricants. The first reason for their vote for Texaco is undoubtedly product quality, based on experience.

The second reason is undoubtedly the Texaco Contractor Representative, shown at work above. This engineer develops Simplified Lubrication Plans and stays with the job . . . at Niagara or at any other project around the globe.

Contractors know lubrication can mean the difference between profit and loss. We have a new book on this subject. Write us for a copy. Texaco Inc., 135 East 42nd Street, New York 17, N. Y., Dept. L-160.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